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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

June 25, 1998

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
Room 222
1919 M Street, N.W.
Washington, D.C. 20554

Re: **CC Docket No. 96-45 - Federal-State Joint Board on Universal Service CC Docket No. 97-160 Forward-Looking Mechanism for High Cost Support for Non-Rural LECs; APD No. 98-1; DA 98-1055**

Dear Ms. Salas:

Enclosed herewith for filing are the original and five (5) copies of MCI Telecommunications Corporation's Comments in the above-captioned proceeding.

Please acknowledge receipt by affixing an appropriate notation on the copy of the Comments furnished for such purpose and remit same to the bearer.

Sincerely yours,

Chris Frentrup

Chris Frentrup
Senior Economist
1801 Pennsylvania Ave, NW
Washington, DC 20006
(202) 887-2731

MCI Telecommunications Corporation

Enclosure

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

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| In the Matter of | ) | |
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| Federal-State Joint Board on | ) | CC Docket No. 96-45 |
| Universal Service | ) | CC Docket No. 97-160 |
| | ) | |
| Forward-Looking Mechanism | ) | APD No. 98-1 |
| for High Cost Support for | ) | DA 98-1055 |
| Non-Rural LECs | ) | |

**COMMENTS OF**
**MCI TELECOMMUNICATIONS CORPORATION**

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MCI Telecommunications Corporation

June 25, 1998

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## SUMMARY

In the Universal Service Order, the Commission allowed states to submit their own forward-looking economic cost studies as the basis for calculating universal service support, and adopted ten criteria that any state-sponsored cost model would have to meet. Numerous states have now filed cost models, using either the Benchmark Cost Proxy Model (BCPM), the HAI Model, or some other company-specific model.

As MCI has discussed in other phases of this docket, the BCPM does not meet the Commission's criteria for a forward-looking economic cost model. None of the states that selected BCPM for one or more of its companies - Indiana, Montana, Nebraska, North Carolina, South Carolina, and Puerto Rico - has adequately explained how BCPM meets the Commission's ten criteria.

The BCPM's most serious failure to satisfy the Commission's criteria is that it fails to model a least-cost, most-efficient network. As a result of its methodology for determining customer locations, the BCPM creates too many serving areas, requires far too much Serving Area Interface/Digital Loop Carrier (SAI/DLC) equipment *and* sub-feeder plant to reach the SAI/DLC in each of these undersized serving areas. Feeder/subfeeder distances also are overstated by BCPM's criteria for steering main feeder and its use of an inefficient "bush" design for configuring subfeeder. In addition, the BCPM's determination of switching, transport, and signaling costs is not forward-looking. Finally, the state's selected inputs for use in the BCPM are inappropriately set. Specifically, the state models assume an

unrealistically small amount of structure sharing, inappropriately base the mix of aerial, buried, and underground plant and the cable fill factors on the LECs' embedded base, and fail to take into account the incentives going forward for an efficient provider of local service to reduce its Network Operation and Overhead expenses below the LECs' historic levels.

The company-specific models submitted by Illinois and Michigan have similar flaws. The loop cost model used in these states fails to minimize the costs of distribution facilities, by placing the SAI at the edge of the distribution area. It also uses an inappropriate mix of aerial and buried structure. These design flaws are evidenced by the fact that the Michigan model uses "closure factors" to bring the inflated cost estimates in line with the unbundled network elements cost results. These state models incorrectly assume no structure sharing will occur and rely on dated switch contracts to determine switch prices. In addition, the depreciation lives used fall outside the Commission's prescribed ranges. The Commission should reject Ameritech Michigan's request for waiver to allow the use of these lives. Finally, the cost study used to set joint and common costs in Illinois has not been available for effective review by interested parties, and should not be used.

For all these reasons, the Commission should either reject these states' models and inputs, or require them to make modifications to bring the models into compliance with the Commission's criteria.

**Before the**
**FEDERAL COMMUNICATIONS COMMISSION**
**Washington, DC 20554**

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| Federal-State Joint Board on Universal Service | ) | CC Docket No. 96-45 CC Docket No. 97-160 |
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| Forward-Looking Mechanism for High Cost Support for Non-Rural LECs | ) | APD No. 98-1 DA 98-1055 |

**COMMENTS OF**
**MCI TELECOMMUNICATIONS CORPORATION**

MCI Telecommunications Corporation (MCI) hereby submits its comments regarding state forward-looking cost studies for universal service support.

## I. INTRODUCTION

In the Universal Service Order,[1] the Commission allowed states to submit their own forward-looking economic cost studies as the basis for calculating universal service support. That Order adopted ten criteria that any state-sponsored cost model would have to meet.[2]

1. The technology assumed in the cost study must be the least-cost, most-efficient, and reasonable technology for providing the supported services

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[1] Federal-State Joint Board on Universal Service, Report & Order, 12 FCC Rcd 8776 (1977) (Universal Service Order).

[2] Universal Service Order at para. 250.

that is currently being deployed.

2. Any network function or element, such as loop, switching, transport, or signaling, necessary to produce supported services must have an associated cost.

3. Only long-run forward-looking economic cost may be included. The long-run period used must be a period long enough that all costs may be treated as variable and avoidable. The costs must not be the embedded cost of the facilities, functions, or elements. The study or model, however, must be based upon an examination of the current cost of purchasing facilities and equipment, such as switches and digital loop carriers (rather than list prices).

4. The rate of return should be either the authorized federal rate of return on interstate services, currently 11.25 percent, or the state's prescribed rate of return for intrastate services.

5. Economic lives and future net salvage percentages used in calculating depreciation expense should be within the FCC-authorized range and use currently authorized depreciation lives.

6. The cost study or model must estimate the cost of providing service for all businesses and households within a geographic region.

7. A reasonable allocation of joint and common costs should be assigned to the cost of supported services.

8. The cost study or model and all underlying data, formulae, computations, and software associated with the model should be available to all interested

parties for review and comment. All underlying data should be verifiable, engineering assumptions reasonable, and outputs plausible.

9. The cost study or model should include the capability to examine and modify the critical assumptions and engineering principles. These assumptions and principles include, but are not limited to, the cost of capital, depreciation rates, fill factors, input costs, overhead adjustments, retail costs, structure sharing percentages, fiber-copper cross-over points, and terrain factors.

10. The cost study or model must deaverage support calculations to the wire center serving area level at least, and, if feasible, to even smaller areas such as a Census Block Group, Census Block, or grid cell in order to target universal service support efficiently.

In addition to these ten criteria, the Commission required that any state-sponsored cost model must also be used to determine the level of support in any intrastate universal service support mechanism, and encouraged the states, to the extent possible, to use their ongoing proceedings for developing permanent unbundled network element (UNE) prices as the basis for their universal service cost model.[3]

The Commission subsequently released a Public Notice detailing the required information that states would have to file in support of their submitted cost models.[4] Numerous states have filed cost models, using either the Benchmark Cost

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[3] Ibid. at para. 251.

[4] State Forward-Looking Cost Studies for Federal Universal Service Support, Public Notice, DA 98-217, released February 27, 1998 (Public Notice).

Proxy Model (BCPM), the HAI Model, or some other company-specific model. MCI comments on the submissions by Indiana, Montana, Nebraska, North Carolina, South Carolina, and Puerto Rico, all of whom have filed BCPM with their own selected inputs, and Illinois and Michigan, who have filed company-specific models.

## II. THE BCPM AS SUBMITTED BY THE STATES DOES NOT MEET THE COMMISSION'S CRITERIA FOR A FORWARD-LOOKING COST MODEL

As MCI has discussed in other phases of this docket, the BCPM does not meet the Commission's criteria for a forward-looking economic cost model. None of the states that selected BCPM has modified it in any way to ensure that it meets those criteria. Therefore, the Commission must reject the state models filed by Indiana, Montana, Nebraska, North Carolina, South Carolina, and Puerto Rico, or at least require the models to be modified as discussed infra to bring them into compliance with the Commission's criteria.

The BCPM's most serious failure to satisfy the Commission's criteria is that it fails to model a least-cost, most-efficient network. As the Commission is aware, all cost proxy models make simplifying assumptions in order to make run times reasonable. However, these simplifying assumptions should be consistent with efficient outside plant design.

The BCPM oversimplifies and misstates the most critical design characteristics of the basic local exchange network. First, it fails to take advantage of the actual customer location information that is currently available in the marketplace. A model should use actual customer location information to the extent it is available, and make assumptions *only* for the remaining customers. Instead of using available information on customer locations, however, the BCPM relies upon a series of unsupported *assumptions* to allocate *all* customer locations to microgrids (areas of approximately 1,500 feet by 1,700 feet that the BCPM arbitrarily overlays on each state).[5] Thus, the BCPM does not employ *any* actual customer location information in designing its carrier serving areas.[6] A cost proxy model that does not include the most accurate demand information available in its algorithms cannot efficiently design its facilities.

In addition, the BCPM relies upon its arbitrarily established grid structure to establish the physical boundaries of its carrier serving areas. As is explained in more detail below, the largest grid size employed by the BCPM is too small to take efficient advantage of existing technology. As a result, the BCPM models too many serving areas in each state, requiring excessive amounts of concentration equipment (*i.e.*, serving area interfaces -- SAIs -- and Digital Loop Carrier -- DLC) and too much subfeeder.

Because of these shortcomings, the BCPM substantially overstates costs,

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5 In rural areas, where universal service support should be the greatest, the BCPM does not design its serving areas to this level of detail. Instead, its serving areas are "macrogrids" areas of approximately 12,000 feet by 14,000 feet.

6 The HAI model accurately geocodes approximately 72 percent of customers nation wide. For customers that currently cannot be geocoded accurately, the HAI Model conservatively ensures that these customers are evenly dispersed along the periphery of the census block within which they are located. Once these surrogate locations have been identified, the HAI Model geocodes these locations and builds distribution plant to serve them.

thus failing to meet the FCC's first criterion for cost models. The carrier serving area design employed by the BCPM—which fails to accurately identify customers or to serve them efficiently—is the most critical design flaw in the BCPM. The resulting inefficiencies affect virtually every other calculation in the BCPM model, resulting in a substantial overstatement of the required amount of universal service support.

## A. The BCPM does not Accurately Calculate the Cost of the Local Loop

There are five critical steps in developing the costs of the local loop, *i.e.*,:

1. identifying residential and business customer locations in each wire center;

2. aggregating these customers into "clusters" that constitute efficient carrier serving areas and distribution areas (which may be subsets of carrier serving areas);

3. properly locating the SAI and/or DLC equipment in each serving area;

4. designing an efficient system of feeders and sub-feeders to connect each of the serving areas to the wire center, consistent with current outside plant engineering practices; and

5. designing an efficient system of distribution plant (backbone, branch, and road cable) to connect individual customer locations to the SAI/DLC equipment.

The BCPM makes critical errors in each of these areas.

### 1. The BCPM does not Identify Customer Locations

The BCPM does not attempt to determine the physical location of customers in designing its network. Instead, it relies upon a series of allocations that distribute all customers in a Census Block ("CB") to a grid network that is arbitrarily overlaid on each CB, based on the assumption that customers should be assigned to each grid in proportion to the amount of a CB's road mileage (for selected road types) that traverses each grid. In doing so, the BCPM assumes that road types such as US highways, State highways, neighborhood roads, and city streets are equally likely to serve basic local exchange customers.

The BCPM customer location assumptions are flawed for several reasons. First, there is no reason to expect that each of the road types selected by the BCPM developers for inclusion in the calculations has an equal probability of serving basic local exchange customers. Neither the BCPM developers nor the states that submitted the BCPM have provided any evidence in support of this "fact", and logic suggests that neighborhood streets are more likely to serve telephone customers than are roads through national parks.

Second, except in neighborhood streets, it is unlikely that customers would be evenly-distributed along the selected roadways. Day-to-day experience demonstrates that customers tend to be clustered, rather than evenly-dispersed along roadways. As is the case in any network industry, it is more efficient to provide basic local exchange service to customers that are grouped together than to serve customers that are evenly dispersed. Thus, the BCPM base-line assumption that customers can be allocated to grids based upon road mileage is unreasonable.

The BCPM developers have not attempted to explain, justify, or support their implicit assertion that customers are (1) evenly distributed to each mile of all included road types, *and* (2) evenly distributed along all included roads. While the HAI Model sponsors have made available granular statistical information about the success of their customer geocoding in over 468 different state/density zone geographical units across the U.S., we are unaware that BCPM has made public any analogous information about its success in locating customers. For example, it would be useful for BCPM to state (1) the number and percent of actual customer locations that are located along the road types that are mapped in the BCPM; (2) a statistical measure indicating how evenly these actual customer locations are dispersed along each of these road types; (3) the number and percent of actual customer locations that are located within the "road-reduced square," *i.e.*, the quadrants in which the BCPM models its distribution plant; and (4) the percent of all road mileage mapped in the BCPM that falls within the "road-reduced square" in which the BCPM models its distribution plant. The provision of these statistics on a national basis, by state, and by density zone within each state would enable interested parties to evaluate whether the BCPM's approach models customer locations accurately, thus meeting criteria 1 and 6. However, neither the states that submitted the BCPM nor the BCPM modelers have made these data available.

### 2. The BCPM does not Use Information on Customer Clustering to Design Loop Plant

In attempting to design serving areas that form the foundation of its feeder and distribution plant design, the BCPM continues its reliance on the artificial "grid" approach. Because the BCPM establishes these grids based on degrees of latitude and longitude, which bear no relationship to the way in which customer population actually is clustered, use of these grids creates arbitrary network design constraints, particularly in sparsely-populated areas. The BCPM's "cookie cutter" approach to serving area design—which artificially prohibits a serving area from straddling the boundary between two of the BCPM's ultimate grids—cannot take actual population clustering properly into account.

Several state commissions have also reached this conclusion. On page 13 of its March 30, 1998 Final recommendation, the Louisiana staff states "staff agrees with AT&T that the BCPM artificially constrains the size of the Carrier Serving Areas. Staff does not understand the need for such a constraint . . . when BellSouth itself deploys 2016 line DLC remote terminals in Louisiana when the demand is large enough. (Response to Staff Data Request 7-15.)" Similarly, in Minnesota the Administrative Law Judge found that "[a] more significant problem is that the grid system that the BCPM uses in designing distribution areas has the effect of breaking up clusters of customers that could be served as a group. This is because that grid system is driven by lines of longitude and latitude rather than by principles of efficient design." (Report of the Administrative Law Judge on Selection of Cost Study, April 2, 1998, page 16, para 69)

In contrast, the HAI Model imposes no artificial geographic constraint on its serving area design. After customers are located, the HAI Model identifies logical groups of customers that can be served together (consistent with technological constraints), and builds efficient serving areas and outside plant accordingly. By using this approach, the HAI Model incorporates engineering judgment and economic decisions in a manner fully-consistent with outside plant engineering concepts, while the BCPM permits its artificial grid structure to "trump" these considerations.

Once customers have been allocated to various ultimate grids in a CB, based upon each grid's proportion of the CB's selected road mileage, the BCPM then (1) divides the ultimate grid (unless it is a micro grid) into as many as four quadrants that are centered at the road centroid of the ultimate grid, (2) calculates the total area comprised within a 500-foot buffer along each side of the specified road types in each quadrant, (3) creates a square distribution area in the quadrant, with an area identical to that created by the 500-foot buffer, (4) centers the square on the "road centroid" of the quadrant, and (5) calculates the amount of required distribution plant by assuming that the quadrant's customers are evenly-distributed throughout the quadrant in square lots. The resulting connecting, backbone, and branch cable is constrained to be no longer than the selected road mileage in the quadrant. These data manipulations effectively "move" customers even further from the microgrid location initially assumed in BCPM's "customer location" approach, creating additional discrepancies.

### 3. The BCPM Uses an Excessive Number of DLCs

There are other reasons to reject the grid approach to serving area design used in the BCPM. The BCPM proponents state that the BCPM macrogrid is approximately 12,000 by 14,000 feet, which represents an area of approximately

6.0 square miles.[7] However, a serving area can be as large as 18,000 by 18,000 feet without violating the engineering requirement that every customer in the carrier serving area be within 18,000 feet of the DLC - - a fact that has been recognized by the FCC staff. Of course, this would require that the DLC be placed at the *geographic* center of the serving area, rather than at the "road centroid" of the serving area (as currently is done in the BCPM). Enlarging the serving area to these dimensions would result in a serving area that is approximately 11.6 square miles – over *twice* the size of the serving area utilized by the BCPM. Thus, modification of the BCPM grid structure from 1/25th of a degree of latitude and longitude to a grid structure set at 18,000 by 18,000 feet would permit a single carrier serving area (and, therefore, a single set of DLC equipment) to serve twice as much area and, on average, twice as many customer locations.

MCI recognizes that while expanding the size of the carrier serving area would allow DLC equipment to serve more customers, there is a limit on the number

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7 A problem with the BCPM grid definition is that because they are defined in terms of degrees of latitude and longitude, the grids are different sizes in different parts of the country due to the curvature of the earth. The distance represented by 1/25th of a degree of latitude (BCPM's macro-grid dimension) varies from 1.85 miles in North Dakota (approximately 9,800 feet) to 2.44 miles in southern Texas (approximately 12,900 feet), a 32 percent discrepancy. By defining grids in terms of degrees of latitude, BCPM creates carrier serving areas that are substantially larger in the southern states than they are in the north. This is particularly troubling because the MapInfo software used by the BCPM has the option of specifying a grid overlay in feet rather than in degrees. While this would not make the underlying assumptions about "grid" design correct, it would at least permit the model to be consistently applied around the country.

of lines that a single piece of DLC equipment can support. In many states, that limitation has been the subject of dispute between the parties. In rural areas that are most subject to universal service support, however, that constraint does not affect MCI's contention that the BCPM's serving areas are too small—in fact, it helps to illustrate this point.

The BCPM developers assume that a single piece of DLC equipment can handle as many as 1,000 customer locations, based on an assertion that DLC equipment can handle a maximum of 1,344 lines (in fact, the BCPM developers previously have told the FCC that its serving areas are *designed* to handle approximately 1,000 customers). In most states, however, the average serving areas reflected in the BCPM runs have contained fewer than 400 lines.[8]

The combination of these flawed design criteria within the BCPM pre-processing phase results in serving areas that are too small and, therefore, serve an artificially small number of customers. The number of lines in these serving areas could easily be doubled, thereby reducing the number of serving areas. This would result in lower investment in DLC equipment, feeder distribution interface ("FDI") equipment, and subfeeder cable. In many states, the HAI Model default run produces a number of serving areas that is approximately half the number of occupied grids in the BCPM for the state, without violating any of the

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[8] Of course limiting the DLC equipment to a maximum of 1,000 lines imposes unrealistic restrictions on the engineering design and many efficiencies which can be realized by utilizing a 2,016 line DLC.

outside plant constraints required to provide current levels of service. As a result, the BCPM places substantially more DLC units than does the HAI Model, significantly overstating costs and thereby failing to meet criteria 1.

**4. The BCPM's Feeder and Sub-feeder Design is Flawed**

The BCPM does not design feeder efficiently. One obvious reason flows from the prior discussion - - by overstating the number of serving areas (or grids), the BCPM creates an artificial need for sub-feeder to connect main feeder routes to each individual serving area.[9] Even if average loop lengths look reasonable, the BCPM feeder design is inefficient, because the extra subfeeder required to reach the inflated number of serving areas may substantially increases costs for structure. In addition, there are two interrelated changes that have been incorporated into the BCPM feeder/sub-feeder design that can be inefficient, *i.e.*, (1) a decision to "split" main feeder when the population in the *center* of a particular north-south-east-west feeder quadrant is below a hard-coded threshold, and (2) a decision to steer main feeder—whether or not it is "split" according to the criteria in step 1 -- toward population concentrations once it is a distance of 10,000 feet from the wire.

The decision to steer feeder can reduce efficiency, because the cost of feeder and sub-feeder is driven by two principal factors, *i.e.*, the amount of cable

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9 This overstatement of required subfeeder plant is not so obvious if one looks solely at the average feeder distance required to reach each customer, as the BCPM proponents have suggested in a number of states. However, if one looks at the total amount of route mileage—which affects the need for structure investment—it becomes clear that the feeder route miles estimated by the BCPM are overstated.

and wire (for metallic cable, this is measured in pair feet) and the amount of structure that must be installed to support the cable and wire. For copper cable, it is clear that steering main feeder toward population clusters should reduce total pair-feet of cable.[10] But at the same time, it can increase the required investment in structure. The BCPM feeder steering algorithms ignore this important tradeoff.

That this is more than a mere hypothetical concern with the BCPM is obvious from even a cursory review of the limited number of BCPM maps that have been produced by the model's proponents. These maps are rife with examples in which (1) main feeder runs on a diagonal to cross a series of right-angle sub-feeders, when a north-south-east-west main feeder would intersect the same sub-feeder routes while traversing a shorter distance, or (2) a split main feeder requires numerous extremely long sub-feeder runs in order to reach each of the grids, when subfeeder would be *shorter* if it connected at right angles to the main feeder.

These problems with the BCPM feeder design arise from a fundamental flaw in the BCPM's feeder steering logic. In the BCPM (as in the real world), structure must be built to each occupied grid, whether that grid contains a single customer or thousands of customers. Unlike investment in copper cable, structure investment is not (with minor exceptions) significantly affected by the number of customers in a grid or the distribution of customers *between* grids (unless, of course, some grids

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10 Because the main feeder split and the steering of main feeder occur only beyond 10,000 feet from the centroid office, almost all of the cable is fiber, not cable. Therefore, very little cost savings for material actually results from feeder steering.

are *entirely* empty). As a result, attempting to minimize structure costs using a process that takes into account the assumed customer population within each grid effectively mis-specifies the optimization analysis.

**5. The BCPM's Distribution Design Overstates Needed Plant**

The BCPM also fails to design its distribution plant to serve customers where they actually are located. As previously discussed, the BCPM does not actually locate customers, it merely approximates locations by allocating customers on the basis of relative road mileage for selected road types, and determines its serving areas based on the grid-based "cookie cutter" approach described earlier. Before designing its distribution plant, however, the BCPM further subdivides grids into one to four square quadrants (depending on where the customers are assigned), with the area of each quadrant set equal to an area created by a 500-foot border on either side of the selected road types in that quadrant.[11] The model then builds backbone and branch cables *only within each quadrant*—reflecting the BCPM's assumption that all customer locations are evenly-distributed within the quadrant.[12]

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11 Normally, these quadrants have a combined area *substantially* smaller than the macrogrid, particularly in rural areas. As a result, they are likely to be geographically located far away the microgrid from locations to which the BCPM initially allocated customers.

12 It is important to note that BCPM assumes that *all* customers - including outlier customers that are actually located sequentially along rural roads outside of towns - are relocated into quadrants in which they are served by backbone and branch cable, as though these customers were located in urban or suburban "tracts". In contrast, the HAI Model identifies these outlier customers, and recognizes that road cable must be installed by the model to provide service to these customers - just as it is in the real world.

In contrast, the HAI Model constructs its distribution plant in geographic areas that match the actual physical locations of customers. To facilitate modeling, the HAI Model converts each serving area into a rectangle. In doing so, however, it preserves the basic area, shape and location of the physical cluster of customers, thereby preserving the appropriate relationship between customers and between customers and the wire center.[13]

There is another subtle feature of the BCPM process for calculating the amount of distribution cable that tends to significantly understate the amount of

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13 As the Commission is well aware, the BCPM proponents have attacked the HAI Model's clustering algorithm by alleging that the resulting amount of backbone and branch cable is far below the amount of cable required by a minimum spanning tree ("MST") analysis. Because this has been the subject of extensive ex parte communications from the HAI Model and BCPM proponents, MCI will not repeat all of its prior arguments here. However, the following facts are relevant. First, the MST does not constitute the minimum distance required to connect a series of customers in a distribution area. Second, many of the HAI Model customer locations have been established by placing non-geocoded points on the boundaries of the CB in which they lie. The FCC previously has concluded that this approach overstates the dispersion of customers, which means that the resulting MST distances would be larger than required to connect actual customer locations. Third, although the BCPM proponents claim that certain features of the HAI Model clustering process lead to significant understatements of backbone and branch cable, results in individual states demonstrate the opposite. In Nevada, for example, total route miles of cable produced by the HAI Model were higher than the route miles of cable Nevada Bell identified for the state as a whole. And in Texas, analyses conducted by MCI and AT&T for two sample groups of wire centers selected by the Public Utility Commission staff (including very rural wire centers) revealed that the HAI Model provided 20 to 30 percent *more* backbone and branch cable than did the BCPM. Because it is backbone and branch cable that "connects the dots" of customers in each model's distribution areas, this is solid evidence that the HAI Model does not understate the amount of distribution cable in the vast majority of cases.

distribution cable, preventing many customers from being served by the BCPM. The BCPM methodology caps the amount of distribution cable in any given quadrant of an ultimate grid at a distance equal to the road feet (of selected road types) in that quadrant. Thus, once the model initially determines the amount of cable required to reach each customer in a quadrant, it checks to see if the resulting number of cable feet is longer than the road feet in that quadrant. If so, it arbitrarily reduces the amount of distribution cable to the amount of road feet, which effectively prevents these customers from being connected to the network designed by the model. In many of the states examined by MCI's consultants, 30 to 50 percent of the quadrants (often serving a higher proportion of total lines) are affected by this cap. This means that the BCPM fails, ultimately, to provide enough cable to serve these customers, because the road mileage in these quadrants is less than the amount of connecting, backbone and branch cable that the BCPM initially calculates is required to get from the DLC location to the customers. This is another in a series of flawed BCPM distribution plant modeling assumptions that effectively "undo" the original customer assignment approach relied upon in the model.

The problems with the BCPM distribution plant design that we have discussed so far tend to understate the amount of distribution plant calculated by the BCPM, but there is one important assumption made by the BCPM that works the other way - - the assumption that all customer lots are square.

Lot shapes generally are determined by property developers who are seeking to maximize the value of the land available for development. Subdividing a parcel into rectangular lots, with the depth greater than the width—as is assumed in the HAI Model—minimizes a developer's road, sidewalk, and driveway expenditures and maximizes the amount of salable acreage. Subdividing a parcel into square lots—which is assumed in the BCPM—would increase a developer's pavement costs, reduce the average homeowner's land area, and generate lots that tend to have undesirable shallow front and rear yards.

Just as square lots would require a developer to install more road feet and driveway feet per household, their use in the BCPM distribution plant calculations requires more outside plant to be installed to reach the same number of households. Because the incentives for developers and telecommunications providers should be the same, *i.e.*, to reduce the amount of infrastructure costs necessary to provide service to a given set of customers, BCPM's square lot assumption is illogical, is not supported by any evidence, and serves to overstate costs. The HAI Model on the other hand, models rectangular lots which are efficient and, therefore, consistent with the way developments are typically laid out.

### 6. The BCPM's Design Flaws Overstate the Cost of the Local Loop

The BCPM's approach to outside plant design consists of (1) disaggregating CB data by arbitrarily assigning business and residential lines to artificial "microgrids" based on road mileage (not telephone or network engineering criteria, or any other characteristics of the data that exist at the "microgrid" level of detail), and (2) reaggregating the data in variably-sized "ultimate grids"—again, not based on telephony or network engineering criteria—that cannot exceed the size of the "macrogrids". Unfortunately, not even this convoluted process prevents small groups of "microgrids" from being isolated, thereby forcing the model to assign them to "those ultimate grids of equal or larger size, located closest to the road centroid."

The process does not stop there. The BCPM then segments each "ultimate grid" into one to four quadrants, which are converted into smaller square distribution areas, based on the non-empty quadrants established. After all these layers of (1) disaggregation into "microgrids," (2) reaggregation into variable "grids," (3) disaggregation into square distribution areas with customers evenly distributed throughout the distribution area, and (4) effectively moving the distribution area closer to the DLC by capping the allowable distance for distribution plant, the BCPM proponents claim that this approach allows them to accurately locate customers and to design appropriately-sized outside plant. Finally, the BCPM developers assume that all customer lots are square.

As a result of this process, the BCPM creates too many serving areas, requires far too much SAI/DLC equipment *and* sub-feeder plant to reach the SAI/DLC in each of these undersized serving areas. Feeder/subfeeder distances also are overstated by BCPM's criteria for steering main feeder and its use of the inefficient "bush" design for configuring subfeeder.

On the other hand, the amount of distribution plant needed by the BCPM can either be overstated or understated. While (1) the "road reduction" assumption used to create the square distribution areas within each ultimate grid where